CHAPTER THREE: WATER DEMAND AND SUPPLY

3.1 INTRODUCTION

The Arizona Department of Water Resources (ADWR) conducted the *Demand and Supply Assessment 1985-2025, Pinal Active Management Area* (Assessment) in 2011 *(See: http://www.azwater.gov/AzDWR/WaterManagement/Assessments/default.htm)* (ADWR, 2011), as preparation for this *Fourth Management Plan for Pinal Active Management Area* (4MP). Chapter 3 of the 4MP updates the data included in the Assessment and identifies and analyzes the implications of that data.

Historically, water users in the Pinal Active Management Area (PAMA) have relied heavily on groundwater. Over the past 30 years, utilization of renewable supplies has increased, facilitated by the completion of the Central Arizona Project (CAP) canal. Although the use of CAP water increased and groundwater use decreased from 1985 through 1993, overall water demand has increased in the municipal, industrial, and tribal use sectors, and agricultural demand continues to fluctuate.

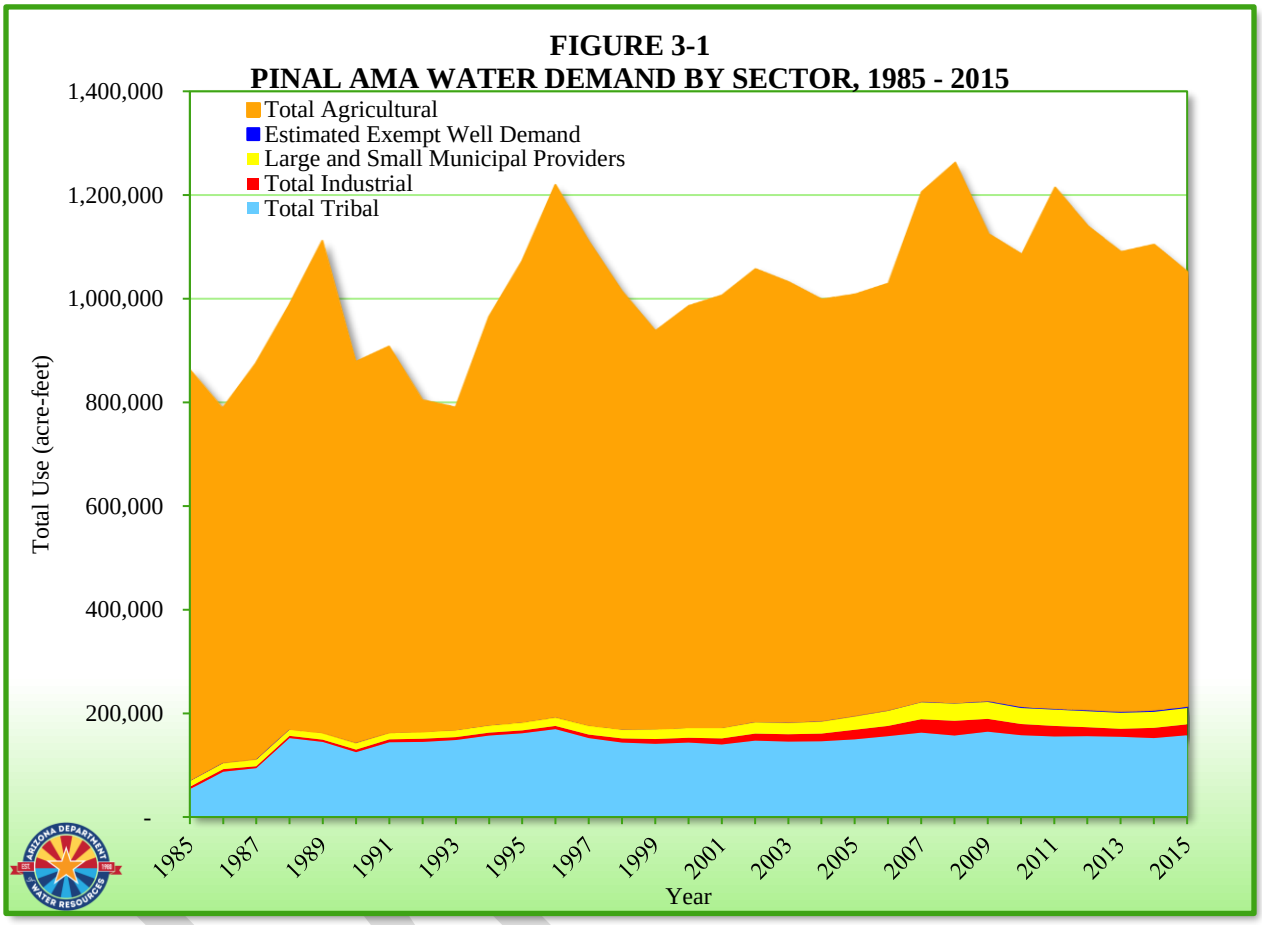
Groundwater remains the primary source of water supply for the PAMA agricultural, municipal, industrial and tribal water use sectors. The agricultural sector, the largest water-using sector in the PAMA, began receiving direct delivery of CAP water in 1987. Peak delivery occurred in 2003. Tribal agricultural water users also began using CAP water in 1987 and tribal CAP use has increased since that initial year. To a somewhat lesser extent, municipal and industrial users in the PAMA have initiated use of small volumes of CAP water. Historical water demand and supplies for each water use sector are discussed in more detail below.

Water demand among the water use sectors has varied between 1985 and 2015 (primarily in the agricultural and tribal agricultural sectors). Figure 3-1 illustrates the fluctuation in agricultural demand, the increase in tribal demand and the increasing trends in municipal and industrial demand from 1985 through 2015. In 1985, tribal demand comprised about six percent of the total PAMA demand. The municipal sector, which is comprised of large and small municipal water providers, accounted for less than two percent of the total PAMA demand, and industrial demand accounted for less than one percent. Agricultural demand accounted for the remainder, which was close to 92 percent. By 2015, agricultural demand was 80 percent of PAMA demand. Tribal demand accounted for about 15 percent, and municipal demand was less than four percent. Industrial demand was two percent.

Tables 3-1A and 3-1B show how much groundwater, surface water, CAP water, and reclaimed water was used by municipal, industrial, agricultural, and tribal water users within the PAMA from 1985 through 2015, as well as estimated water use from private, domestic wells for the same period. In Table 3-1A, municipal water use includes water delivered for non-irrigation uses by a city, town, private water company or irrigation district. Municipal demand is composed of the large municipal provider and small municipal provider subsectors**.** Turf-related facilities, which have their own conservation requirements under the management plan, are included in the large and small municipal provider demand category if they receive water from a municipal provider. Note that for purposes of categorizing water demand in the Assessment, ADWR included estimated water demand associated with domestic exempt wells in the municipal demand category. However, for the 4MP, ADWR is showing estimated exempt well demand as a separate category of use. An exempt well is a well with a pump capacity of 35 gallons per minutes or less; ADWR has no regulatory authority over water withdrawn from exempt wells. In general, industrial users withdraw water from their own wells that are associated with Type 1 and Type 2 non-irrigation grandfathered groundwater rights, General Industrial Use (GIU) groundwater withdrawal permits or other withdrawal permits. In the PAMA, industrial demand is composed of the following subsectors: mining, turf, sand and gravel, electric power, dairy, feedlot, de-watering and other. Agricultural demand is composed of the use of water by

Irrigation Grandfathered Groundwater Rights (IGFRs) for agricultural uses not on tribal land, as well as the lost and unaccounted for water associated with the delivery of agricultural water. Agricultural use is use of water to irrigate two or more acres of land to produce crops or feed. Tribal demand is composed of municipal, industrial and agricultural demand on tribal land. Tribal water use is exempt from state regulation; however, it is included in ADWR water budgets because of the physical impacts on the aquifer.

FIGURE 3-1
PINAL AMA WATER DEMAND BY SECTOR, 1985 - 2015



Municipal demand has been gradually increasing in the PAMA since 1985, peaking in the year 2007. The reduction in municipal demand in subsequent years may be due, at least in part, to the economic downturn. However, data from the Central Arizona Groundwater Replenishment District (CAGRD) and Annual Water Withdrawal & Use Reports for large providers with service areas comprised mostly of post-2000 housing stock indicates that the water demand of new homes is much less than older homes, and less than the Third Management Plan (3MP) models for new residential development.

As municipal demand has increased over time, the proportion of the demand met with groundwater has generally remained the same. Use of CAP and reclaimed water have grown, but not proportionately with the municipal sector's rate of growth. Likewise, industrial demand continues to be dominated by groundwater use, although reclaimed use also shows a steady increase in the industrial sector. Both the municipal and industrial sectors use small volumes of surface water.

TABLE 3-1(A)
PINAL AMA WATER DEMAND, 1985 - 2015 (ac-ft)
MUNICIPAL, EXEMPT WELLS, & INDUSTRIAL

Year	Municipal				Exempt Wells	Industrial			
	Groundwater	Surface	CAP	Reclaimed	Groundwater	Groundwater	Surface	CAP	Reclaimed
1985	12,984	0	0	0	175	4,946	0	0	9
1986	13,328	989	0	0	188	4,682	0	0	10
1987	14,290	989	0	0	202	4,108	0	0	12
1988	14,318	784	0	0	217	4,300	0	0	12
1989	14,828	809	0	0	233	4,309	0	0	12
1990	14,557	408	0	0	251	4,726	0	0	149
1991	14,406	634	0	0	270	5,442	0	0	132
1992	14,780	717	0	23	290	5,865	0	0	158
1993	15,080	651	0	0	312	5,026	0	0	166
1994	15,828	611	71	23	335	5,216	0	0	182
1995	17,006	558	276	0	360	5,471	0	0	176
1996	18,175	507	111	0	387	6,234	0	0	200
1997	18,524	435	439	26	416	6,389	64	0	195
1998	18,675	503	82	33	448	7,866	0	0	232
1999	18,996	238	1,238	445	481	9,347	0	0	243
2000	19,715	94	947	196	517	9,328	45	0	280
2001	19,178	417	2,095	516	731	11,435	106	39	303
2002	20,177	184	3,828	341	945	11,914	91	1,007	453
2003	21,179	109	2,992	260	1,159	12,716	174	860	441
2004	21,225	96	3,368	831	1,373	13,508	160	937	441
2005	23,138	511	3,134	612	1,586	15,640	196	1,630	1,230
2006	26,375	347	2,961	765	1,800	17,042	24	1,462	1,715
2007	31,188	475	2,724	380	2,014	22,033	130	1,742	2,000
2008	31,088	499	2,685	475	2,228	24,332	64	2,236	1,791
2009	30,333	496	2,991	486	2,442	20,611	153	1,420	2,829
2010	29,942	517	2,312	194	2,656	19,114	20	791	1,641
2011	30,768	266	2,047	234	2,841	18,514	22	0	1,663
2012	30,769	253	1,686	311	3,039	15,543	45	0	1,846
2013	29,778	181	2,174	308	3,251	14,387	32	0	1,295
2014	30,123	240	2,373	241	3,478	17,760	172	0	1,899
2015	24,336	292	7,968	867	3,720	18,698	29	0	2,259

Agricultural water use in Table 3-1B includes water deliveries by irrigation districts as well as groundwater withdrawals pursuant to individual IGFR holders. In-lieu Groundwater consists of CAP water (or other renewable supplies) delivered to Groundwater Savings Facilities (GSFs). This water is referred to as in-lieu because the farmers use the CAP water in lieu of pumping groundwater, which results in a groundwater savings. This savings is accounted for as a stored water credit (long-term or annual) for the entity that supplied the CAP water to the farmer. In-lieu water counts as groundwater in the farmer's flexibility account, which determines compliance with the IGFR annual groundwater allotment. In-lieu groundwater is counted as groundwater in the calculation of overdraft. GSFs are discussed further in Chapter 8, titled

Underground Water Storage, Savings & Replenishment. Tribal water use includes municipal, industrial and agricultural uses. Beginning in the year 1987, CAP water has been used for tribal agricultural demand.

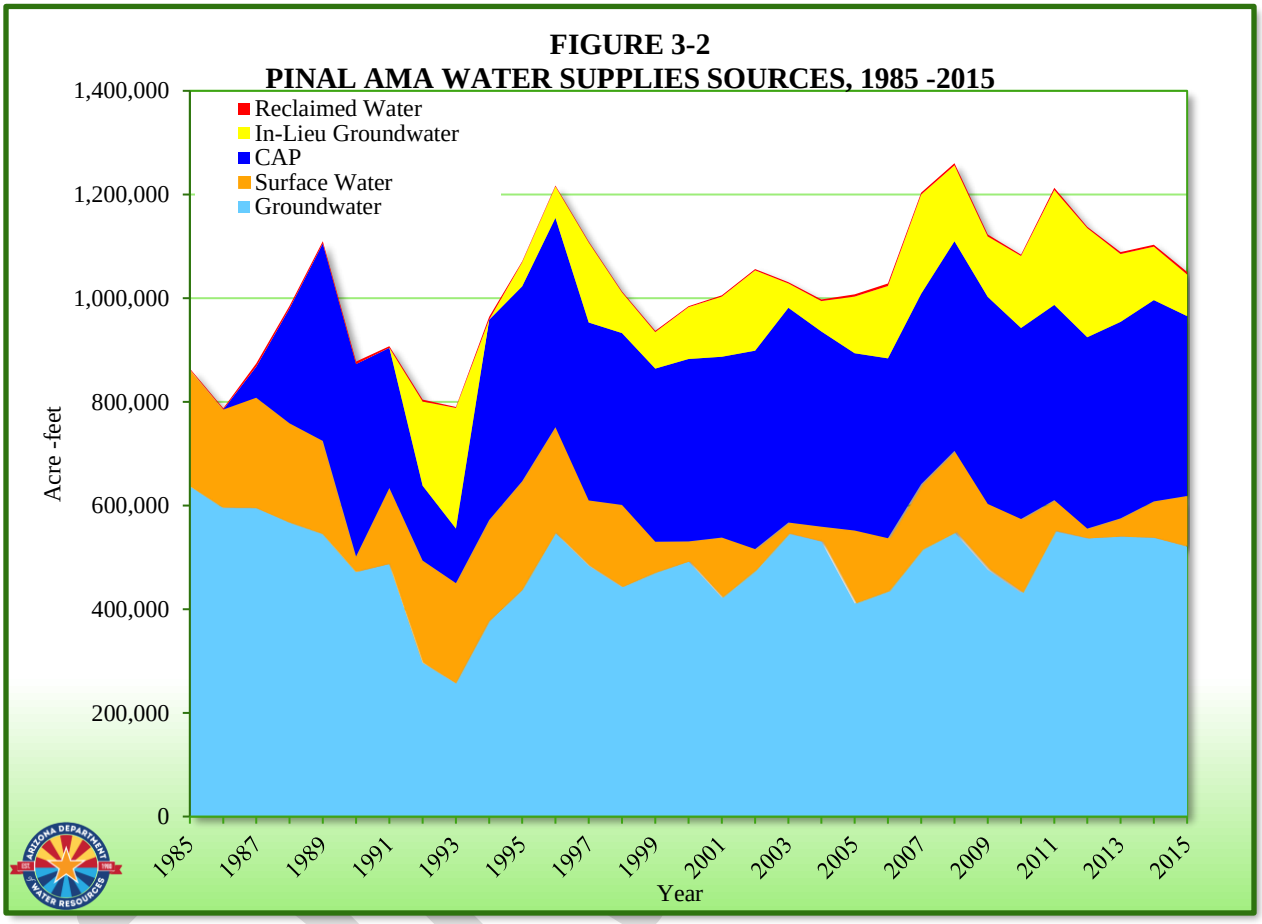
TABLE 3-1(B)
PINAL AMA WATER DEMAND, 1985 - 2015 (ac-ft)
AGRICULTURAL & TRIBAL

Year	Agricultural					Tribal			
	Groundwater	In-lieu GW	Surface	CAP	Reclaimed	Groundwater	Surface	CAP	Reclaimed
1985	594,844	0	195,409	0	1,839	24,525	29,120	0	0
1986	516,756	0	161,870	0	2,534	60,962	26,560	0	0
1987	529,846	0	183,626	41,008	5,831	46,580	28,480	19,000	0
1988	489,247	0	161,820	157,308	5,297	59,237	28,800	64,000	0
1989	472,955	0	150,081	317,407	4,847	52,374	29,280	63,000	0
1990	399,092	0	24,399	303,989	5,014	52,692	5,600	67,000	0
1991	416,508	0	124,924	198,417	2,437	50,049	21,920	72,000	0
1992	228,777	162,196	169,824	73,520	3,186	47,007	26,720	71,000	0
1993	188,049	232,854	169,543	28,296	1,405	48,124	23,520	77,000	0
1994	306,000	0	166,623	306,452	5,546	49,242	28,000	80,000	0
1995	355,983	46,254	181,892	300,145	1,626	58,199	27,200	76,000	0
1996	462,628	60,505	175,665	321,605	1,986	59,477	28,000	82,000	0
1997	395,603	154,564	107,919	270,696	1,329	63,154	17,280	72,000	0
1998	355,444	78,435	139,831	266,686	1,091	59,792	18,560	65,000	0
1999	378,901	70,490	50,064	263,765	1,490	62,349	9,760	69,000	0
2000	400,668	99,908	25,807	282,101	1,625	61,547	12,960	69,000	0
2001	328,962	116,350	101,430	282,393	1,585	61,544	14,400	64,000	0
2002	379,187	155,318	38,062	296,062	1,550	62,342	2,880	81,920	0
2003	447,705	46,632	16,858	332,470	1,789	62,819	4,640	77,800	0
2004	431,700	58,505	22,084	295,613	1,608	62,537	6,400	76,840	0
2005	309,657	109,426	123,010	265,672	2,126	60,774	16,960	72,000	0
2006	327,702	139,616	88,653	261,598	2,325	61,412	13,600	80,720	0
2007	397,313	191,407	112,482	275,919	1,657	61,919	13,982	86,580	0
2008	427,462	146,008	147,405	314,613	2,165	62,946	9,484	84,895	0
2009	358,918	116,639	114,711	305,785	879	63,307	11,984	89,122	0
2010	317,971	138,867	123,584	287,837	736	61,921	18,207	77,622	0
2011	433,649	221,561	51,642	292,204	2,070	64,507	8,137	82,676	0
2012	422,489	210,328	15,559	279,595	790	64,270	3,459	87,925	0
2013	428,597	130,820	30,842	290,834	1,949	63,955	4,068	86,413	0
2014	423,119	103,117	63,441	303,649	1,304	63,272	6,440	82,270	0
2015	410,895	80,627	85,477	256,136	1,842	63,248	11,606	82,699	0

Figure 3-2 shows the sources of supply used to meet demand by all the sectors in the PAMA during the historical period from 1985 – 2015. Municipal groundwater and CAP water use increased over the historical period. Industrial groundwater and reclaimed water use also increased. PAMA agricultural demand has fluctuated over time, but groundwater has remained the predominant supply. The agricultural sector makes use of large volumes of CAP water each year, as well as in-lieu CAP. Agricultural surface water varies

annually with supply conditions and demand. Since 1988, tribal water demand has been fairly constant. The primary sources of supply used include groundwater and CAP water. Tribal water demand is primarily for agricultural purposes in the PAMA.

FIGURE 3-2
PINAL AMA WATER SUPPLIES SOURCES, 1985 -2015



3.2 OVERVIEW OF DEMAND AND SUPPLY BY WATER USE SECTOR

3.2.1 Municipal Sector

The PAMA includes portions of Pinal, Maricopa and Pima counties. Incorporated cities and their 2010 Census populations include Casa Grande (48,571), Maricopa (43,482), Florence (25,536), Eloy (16,631), and Coolidge (11,825). It is important to note that the incorporated area population and the population of the water service area do not precisely correspond. Some municipalities serve outside their municipal boundary, and some municipalities are served by one or more private water companies rather than solely by a municipal entity. The PAMA 2010 Census population within unincorporated areas of the three counties totaled approximately 45,473 people. The 2010 Census population for the Ak-Chin Indian Community, Gila River Indian Community (GRIC), and Tohono O'odham Nation located within the PAMA boundaries was approximately 5,985 people. More than 98 percent of the region's population resides within the Eloy and Maricopa-Stanfield groundwater sub-basins, which includes the cities of Casa Grande, Coolidge and Eloy and the Town of Florence, as well as several state and federal prisons. The remaining population is centered in the Santa Rosa Sub-basin which is located primarily within the Tohono O'odham Nation's boundaries. The majority (40 percent) of the population in the PAMA is served by Arizona Water Company

- Pinal Valley system, which serves the majority of the population within the municipalities of Casa Grande and Coolidge.

Large provider population in the PAMA was 156,800 people in 2010. Providers who currently meet the definition of large municipal water providers (those using more than 250 ac-ft of water per year) include Arizona Water Company – Pinal Valley System, Santa Cruz Water Company, Johnson Utilities – Pinal, the Town of Florence, the City of Eloy, Thunderbird Farms Improvement District, Picacho Water Company, San Carlos Irrigation District, the Florence state prison and Eyman state prison. San Carlos Irrigation District has been identified as a large untreated water provider. Large untreated providers serve 100 or more ac-ft of water for non-irrigation uses within their service areas, generally for residential and commercial flood irrigation of turfgrass. Evergreen Irrigation District was a large untreated provider during the 3MP, but has been delivering less than 100 ac-ft per year for several years and is now considered a small provider. Small providers served 7,676 people in 2010. ADWR estimates that in 2010 there were 27,042 people relying on exempt wells (or hauled water), who were not served by a municipal water provider.

3.2.2 Exempt Wells

Since 1985 the number of exempt well registrations in the PAMA increased more than 200 percent, from 890 exempt well registrations in 1985 to 2,894 exempt well registrations in 2015. The number of exempt well registrations added each year was higher from 1999 through 2006 than in years prior or since *(See Figure 3-3)*. There were more Notices of Intent (NOI) applications filed to drill exempt wells in 2005 than in any other year. Recent numbers of new exempt wells are lower than the annual rate of new NOIs prior to 1999 *(See Figure 3-3)*. Of the 188 NOIs submitted in 2005 none were within the exterior boundaries of a municipal provider holding a Designation of Assured Water Supply (DAWS). Rather, the NOIs for these 188 exempt wells were concentrated in three areas: west of Casa Grande, north of Eloy and southeast of Florence, outside of incorporated areas, municipal provider service areas, and any private water company franchise areas (Certificate of Convenience and Necessity boundaries). In 2005, the Arizona State Legislature passed Senate Bill 1190, to include A.R.S. § 45-454(C) which prohibits exempt wells within 100 feet of the operating distribution system of a DAWS provider, unless exempted based on the specific requirements of the law.

3.2.3 Estimated PAMA Population and the 2010 Census

Figure 3-4 compares the large and small provider population with the large and small provider demand from 1985 through 2015. Slight dips or increases in the population seem to occur as the over-or under-estimation of the population estimate is corrected by the actual Census data. Each decennial US Census is used to calibrate the inter-Census population estimates to the actual population count from the Census.

Between the 2000 Census and the 2010 Census, the exempt well population appears to have increased by an estimated 16,573 people. ADWR conducted a detailed analysis of 2010 Census data and the historical estimate of exempt well population figures included in the Assessment. Due to a change in the methodology used to compile large provider Census population between the 2000 and 2010 Censuses, ADWR believes that the disaggregation of 2000 US Census data to large municipal provider service areas included people who may actually have been served water via exempt wells.

FIGURE 3-3
PINAL AMA EXEMPT WELL REGISTRATIONS ISSUED, 1985 - 2015

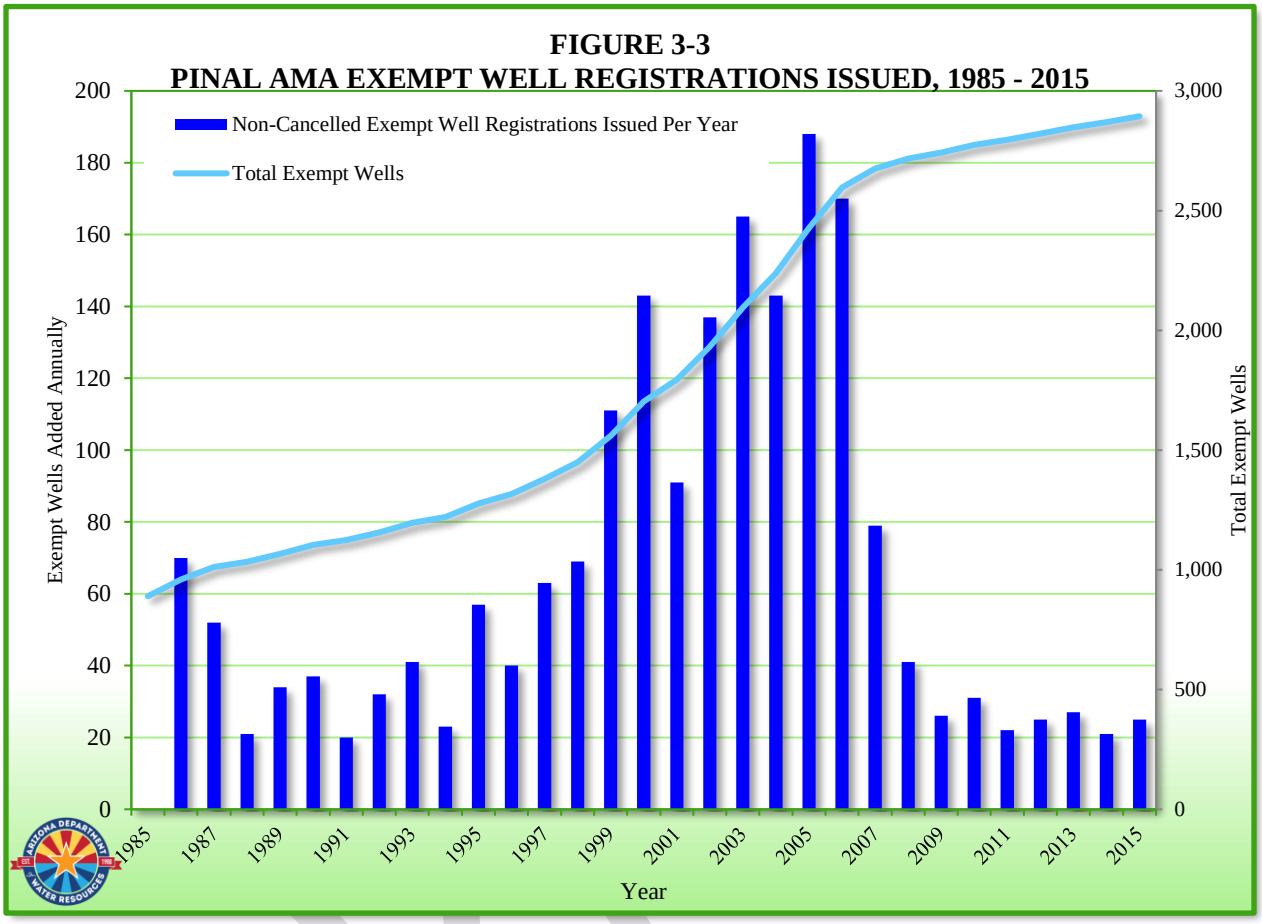


FIGURE 3-4
PINAL AMA POPULATION & DEMAND, 1985 - 2015

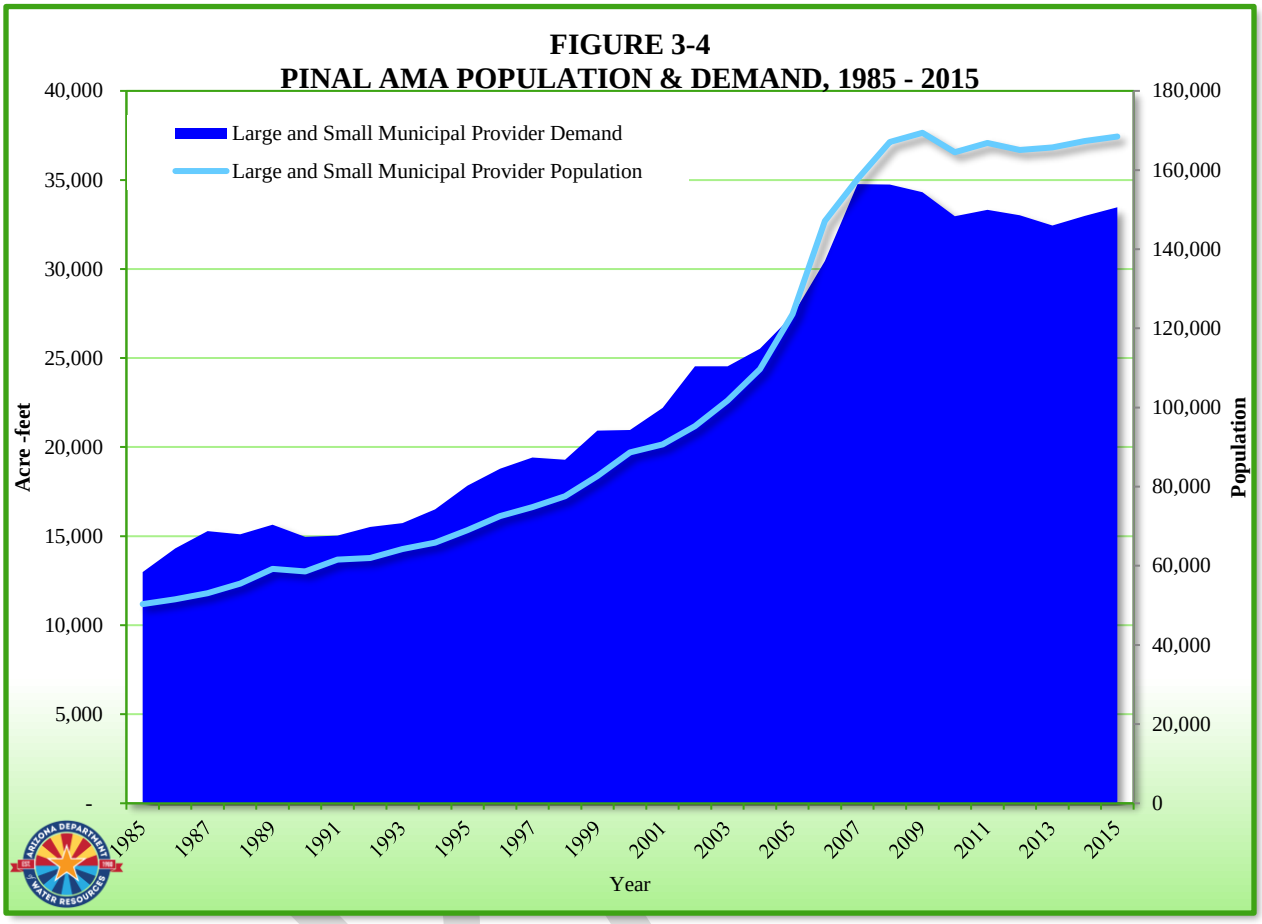


Table 3-2 shows the population figures based on the 2010 US Census. Overestimation of population in between Censuses results in a downward bias in Gallons per Capita per Day (GPCD) figures. Census years represent an actual count of persons residing within water provider service areas in AMAs. Looking just at the Census years, the large municipal provider GPCD rate in the PAMA was 227 GPCD in 1990. It was 206 GPCD in 2000, and it was 173 GPCD in 2010. Water conservation activities, the use of new, low water using fixtures, and newer homes with low water using landscapes, result in reductions in GPCD over time. Other factors that affect GPCD are weather conditions and water cost. The low GPCD figure in 2010 may be due to loss of income associated with the economic downturn and subsequent cut back in outdoor watering, as well as possible weather conditions (2010 experienced higher than average precipitation).

Multiple factors affect the GPCD rate, sometimes making it an unreliable measure of actual water conservation efforts. However, GPCD can be used as a basic indicator of consumption rates in the absence of more detailed data, such as end-use metering or data-logging, which cost more to collect. Taking into consideration these factors, the data indicate that overall average GPCD rate for PAMA large providers has reduced about 1.4 percent per year since the year 2000. GPCD rates for some individual large water providers decreased more than that rate, while some large providers in PAMA experienced increased GPCD rates.

TABLE 3-2
PINAL AMA POPULATION BY WATER PROVIDER TYPE, 1985 – 2015

Year	Total PAMA Population	Large Provider Population	Small Provider Population	Exempt Well Population	Total Exempt Wells
1985	58,687	42,164	8,167	1,386	890
1986	59,948	43,529	8,000	1,490	960
1987	61,562	44,692	8,381	1,602	1,012
1988	64,085	46,250	9,267	1,722	1,033
1989	67,864	49,210	9,998	1,851	1,067
1990	67,350	48,644	9,952	1,990	1,104
1991	70,474	51,011	10,601	2,139	1,124
1992	70,937	52,731	9,224	2,300	1,156
1993	73,324	54,778	9,432	2,472	1,197
1994	75,142	56,285	9,597	2,657	1,220
1995	78,421	59,160	9,841	2,856	1,277
1996	82,200	62,407	10,199	3,071	1,317
1997	84,611	64,378	10,447	3,301	1,380
1998	87,613	66,500	11,119	3,548	1,449
1999	92,893	70,478	12,193	3,814	1,560
2000	99,143	78,823	9,851	4,100	1,703
2001	102,845	80,563	10,155	5,796	1,794
2002	109,108	84,857	10,468	7,491	1,931
2003	117,222	91,059	10,723	9,187	2,096
2004	126,743	98,900	10,745	10,883	2,239
2005	142,355	112,190	11,409	12,579	2,427
2006	167,528	136,243	10,872	14,274	2,597
2007	179,782	148,808	8,903	15,970	2,676
2008	190,824	158,306	8,791	17,666	2,717
2009	194,800	161,777	7,638	19,361	2,743
2010	191,518	156,800	7,676	21,057	2,774
2011	195,351	158,720	8,157	22,525	2,796
2012	195,083	157,318	7,755	24,096	2,821
2013	197,363	157,962	7,747	25,776	2,848
2014	200,779	159,454	7,909	27,574	2,869
2015	203,810	160,605	7,901	29,497	2,894

NOTE: Exempt Well Population does not include estimated population on tribal lands.

3.2.4 Large Untreated Providers

In addition to large and small municipal water providers, two entities are regulated as large untreated providers in the PAMA. A large untreated provider serves 100 or more ac-ft per year or 500 or more people per year with untreated water for non-irrigation purposes, usually for residential or commercial flood irrigation of turf. Water demand by large untreated providers has declined since 1985, stabilizing at approximately 700 ac-ft per year. The proportion of supplies used by untreated providers varies from year to year. The primary sources of supply are surface water and groundwater. In 2015, about 49 percent of the total water used by large untreated water providers was groundwater and 42 percent was surface water.

However, the 1985 – 2015 average supply mix was 29 percent groundwater and 66 percent surface water. The remainder of the untreated provider supply is untreated CAP water.

3.2.5 Industrial Sector

The *1980 Groundwater Code* (Code) defines industrial use as a non-irrigation use of water, not supplied by a city, town or private water company, including animal industry use such as dairies and cattle feedlots, and expansions of those uses. In general, industrial users withdraw water from their own wells that are associated with grandfathered groundwater water rights (Type 1 and Type 2 rights) or withdrawal permits. Although industrial users are primarily dependent on groundwater, some use renewable supplies such as CAP water or reclaimed water. Historically, industrial uses in the PAMA have included dairies, turf-related facilities, cattle feedlots, sand and gravel operations, mining, and more recently, electric power generation *(See Table 3-3)*.

TABLE 3-3
PINAL AMA INDUSTRIAL WATER DEMAND BY SUBSECTOR, 1985 – 2015 (ac-ft)

Year	Turf-Related Facilities	Feedlot	Sand & Gravel Operations	Dairies	Other	Large-Scale Power Plants	Metal Mining	Total
1985	1,280	2,370	557	245	478	0	25	4,955
1986	1,390	2,080	361	345	489	0	27	4,692
1987	1,371	1,415	350	395	555	0	34	4,120
1988	1,434	1,359	319	506	683	0	11	4,312
1989	1,502	1,091	388	554	781	0	5	4,321
1990	1,504	1,476	268	697	925	0	5	4,875
1991	1,564	2,049	342	711	882	0	26	5,574
1992	2,297	1,572	625	806	718	0	5	6,023
1993	1,419	1,555	559	867	789	0	3	5,192
1994	2,136	1,504	277	869	608	0	4	5,398
1995	2,289	1,334	253	1,030	712	0	29	5,647
1996	2,311	1,562	236	1,498	762	0	65	6,434
1997	2,161	1,524	286	1,700	885	0	92	6,648
1998	2,376	1,682	339	2,042	1,499	0	160	8,098
1999	2,754	2,082	286	2,079	2,307	0	82	9,590
2000	2,744	2,645	277	2,058	1,873	0	56	9,653
2001	2,989	2,676	86	2,630	3,460	0	42	11,883
2002	5,224	2,448	1,526	3,259	933	0	75	13,465
2003	4,652	2,342	1,326	4,679	1,104	0	88	14,191
2004	4,801	1,912	1,368	5,980	963	0	22	15,046
2005	6,420	2,385	1,145	7,584	1,075	73	14	18,696
2006	6,286	3,033	1,199	8,400	1,229	96	0	20,243
2007	8,432	3,064	2,231	9,794	2,254	130	0	25,905
2008	7,020	3,008	2,955	10,072	5,206	163	0	28,423
2009	6,215	2,958	949	9,131	5,635	126	0	25,014
2010	5,543	1,534	353	10,830	3,305	0	0	21,565
2011	4,925	1,788	371	10,131	2,984	0	0	20,199
2012	4,475	1,637	572	8,165	2,585	0	0	17,434
2013	3,976	1,685	481	7,608	1,964	0	0	15,714

Year	Turf-Related Facilities	Feedlot	Sand & Gravel Operations	Dairies	Other	Large-Scale Power Plants	Metal Mining	Total
2014	5,766	1,883	302	9,906	1,974	0	0	19,831
2015	6,029	1,108	303	11,086	2,460	0	0	20,986

Industrial use is largely dependent on population growth and the economy. In some cases, the difference between the actual water use and the total annual allotment at an individual industrial facility is substantial, and is generally a remnant of the allocation process used to establish Type 2 rights. This process assigned users allotments based on the highest annual groundwater withdrawal between the years 1975 and 1980. In 2015, less than 40 percent of the PAMA's industrial rights and permit volumes were used.

The dairy industrial subsector holds 28 percent of the total industrial right and permit allotment. Industrial uses without a specific industrial subsector conservation program, that are regulated only as all industrial users, hold 40 percent of the total industrial right and permit allotment. Turf related facilities hold 14 percent of the industrial sector right and permit allotment. The remaining 18 percent of industrial right and permit allotment is held by the cattle feedlots, metal mining, electric power generation and sand and gravel operation industrial subsectors.

Water use within the industrial sector in the PAMA was relatively small and stable between 1985 and 1995. Total industrial water use in the PAMA was 4,955 ac-ft in 1985 and 5,647 ac-ft in 1995 and represented less than one percent of the PAMA's total water demand. During that period, turf facilities and cattle feedlots dominated the PAMA's industrial water use. However, in the next decade dairy water use grew exponentially and total water demand in the industrial sector increased 264 percent. Industrial demand in the PAMA peaked in 2008 at 28,423 ac-ft, but declined until 2014. In 2015 the industrial sector used 20,986 ac-ft of water. Groundwater has been, and continues to be, the primary source of industrial water supply in the PAMA as shown in Table 3-1A.

In the PAMA, the industrial subsectors that will most likely be influenced by future population growth are turf facilities, electric power generation, and sand and gravel operations. Although changes in population may affect local water use in a subsector, there may be exceptions. Unlike turf development, which tends to be located near the population that benefits from it, electric power is often generated a considerable distance from its users. In other words, local population growth does not always mean a similar increase in local power generation and associated water use.

Factors that could affect dairy water use in the PAMA include land prices in both the Phoenix AMA (PHXAMA) and the PAMA, the availability and price of feed, and the price of milk. In addition to the dairy subsector, the cattle feedlot and mining subsectors are also commodity driven subsectors that are dependent on the local and global economy. Historical non-tribal mining water use was such a low volume in the PAMA that it was assumed that no mining water use would occur in the future. The only significant mining in the PAMA is on tribal land; this water use is not reported to ADWR. Florence Copper is permitted to withdraw up to 806 acre-feet per year for in-situ mining.

In the Assessment, industrial demand was projected to be between 23,000 and 34,000 ac-ft in the year 2015. Actual industrial demand in 2015 was about 21,000 ac-ft.

3.2.6 Agricultural Sector

The agricultural sector in the PAMA is comprised of farm acreage of two acres in size or larger actively irrigated with groundwater from 1975 to 1980. Agricultural lands that used groundwater to irrigate crops during this time period were issued an IGFR by ADWR. Water use pursuant to these rights must be reported to ADWR if the right is larger than 10 acres.

Agriculture is the largest demand sector in the PAMA although municipal and industrial uses have increased somewhat since 1985. Four irrigation districts; *Central Arizona Irrigation and Drainage District (CAIDD), Maricopa-Stanfield Irrigation and Drainage District* (*MSIDD), Hohokam Irrigation and Drainage District (HIDD),* and *San Carlos Irrigation and Drainage District (SCIDD),* in PAMA used 716,830 ac-ft of water in 2015 on more than 233,000 irrigation acres. Table 3-4 summarizes the water use by source of supply and irrigation acres by district in PAMA for the year 2015.

As of 2015, approximately 21,000 active irrigation acres in the PAMA were farmed outside of any irrigation and drainage district. The primary source of water for these farms is groundwater.

TABLE 3-4
PINAL AMA AGRICULTURAL DEMAND & IRRIGATION ACRES
BY DISTRICT FOR THE YEAR 2015

	CAIDD	MSIDD	SCIDD	HIDD	No District	TOTAL
Groundwater	164,841	124,443	50,638	32,876	36,596	409,395
In-Lieu	24,148	34,700	0	21,779	0	80,627
CAP	99,558	111,735	8,613	36,230	0	256,136
Surface Water	0	0	85,477	0		85,477
Reclaimed			1,176		666	1,842
TOTAL WATER USE	288,547	270,878	145,904	90,885	37,262	833,476
Acres	84,745	76,448	44,936	27,687	21,246	255,062

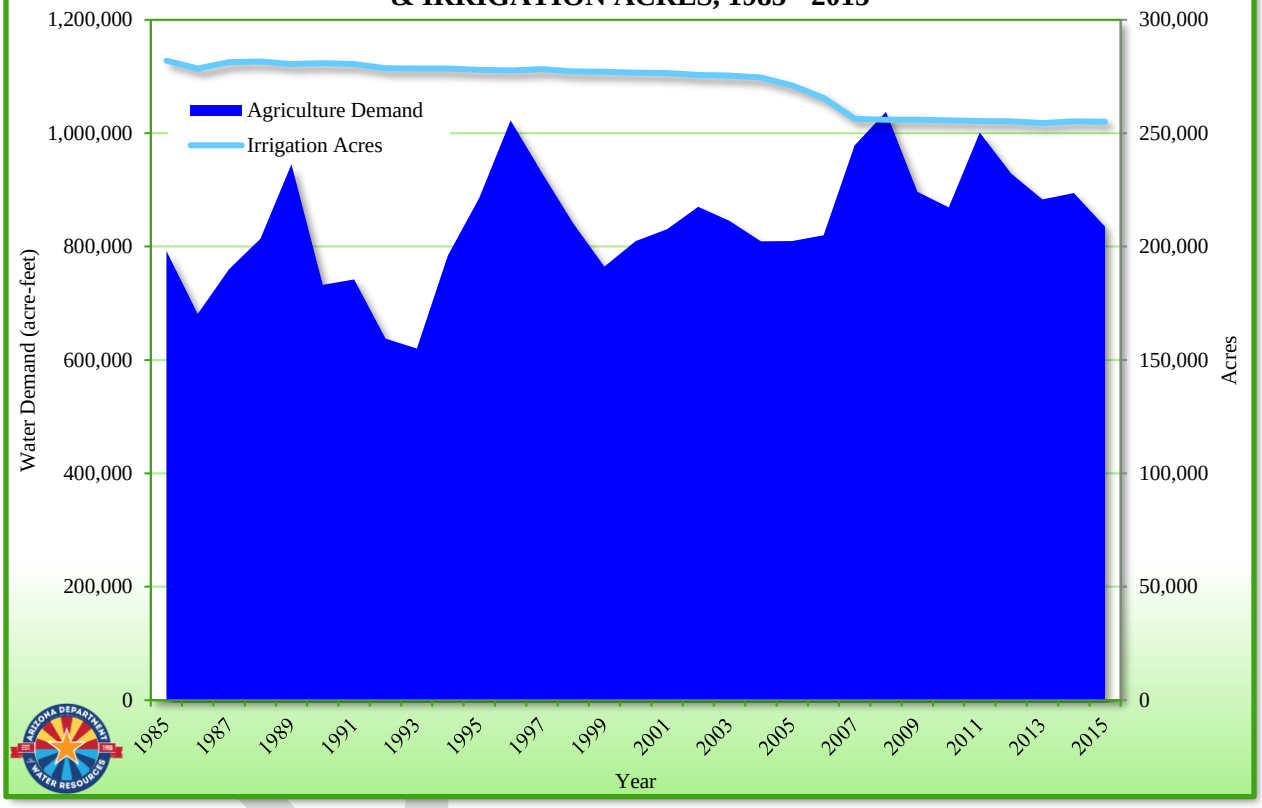
In 1985, agricultural sector demand equaled 92 percent of the total PAMA demand. In 2006, this sector's demand comprised 80 percent of the PAMA demand. In 2015 the agricultural demand was 834,976 ac-ft including system losses and small exempt users. As of 2015, there were nearly 1,400 active IGFRs in PAMA with allotments totaling 625,931 ac-ft. Figure 3-5 shows historical agricultural water use from 1985 through 2015 and the total acres eligible for irrigation.

Since 1995 there have been 160 IGFRs that were partially or fully extinguished in PAMA pursuant to the Assured Water Supply (AWS) Rules. This represents more than 13,000 acres that can no longer be used for agricultural production. Extinguishment of these rights generated nearly 19,600 ac-ft per year of extinguishment credits, of which 13,428 ac-ft per year have been pledged to meet the consistency with goal criterion of proving a 100-year AWS. The remainder (6,165 ac-ft per year) have not been pledged.

In 2007, the AWS Rules were modified for the PAMA. One of the changes to the AWS Rules resulted in a capping on extinguishment credits. In the Prescott, Phoenix and Tucson AMAs, GFRs may be extinguished through the year 2025. Before the PAMA 2007 and subsequent AWS Rule modification, there was no end date for extinguishment of GFRs in the PAMA. The modified rule allows GFRs to be extinguished in PAMA through the year 2055. Another change to the extinguishment provisions of the AWS Rules for

PAMA is related to the volume of the extinguishment credit. Before the rule change, extinguishments in PAMA were an annual allocation of which any unused volume in a given year would roll over to the next year. Under the modified AWS Rule for the PAMA, extinguishment credits are a one-time, lump sum volume, which is the same as extinguishment credits that are generated in the Phoenix, Tucson, and Prescott AMAs. And also like the other AMAs, under the new AWS Rule for PAMA, there is no rollover provision for GFRs that are extinguished after September 2007. Since the rule change, three extinguishments have been issued under the new provisions for a one time, lump sum value of 8,700 ac-ft. The credits associated with these post-rule change extinguishment certificates were not pledged as of November 2015.

FIGURE 3-5
PINAL AMA AGRICULTURAL WATER DEMAND & IRRIGATION ACRES, 1985 - 2015



In 2010, ADWR received permission from the Governor's Office to amend its AWS Rules to address concerns raised by the agricultural and development communities regarding agricultural lands within AMAs for which IGFRs were extinguished during 2005, 2006 and 2007. The IGFRs were extinguished by the landowners in exchange for AWS extinguishment credits in anticipation of development occurring on the lands. Due to the economic recession, many of these lands have not been developed and are not anticipated to be developed in the near future. Because the lands no longer have an IGFR, they cannot be put into agricultural production, which may create an economic hardship for the landowners. These idle, vacant lands also create dust control issues and negative aesthetic values for the communities where they are located. ADWR conducted a rulemaking process to amend A.A.C. R12-15-723 to allow the owners of these lands to apply to ADWR to have their extinguished IGFRs restored if certain conditions are met. The Governor's Regulatory Review Council approved the proposed rule on September 13, 2011, which became

effective immediately. As of April 2015, no IGFRs in the PAMA that were extinguished have been reverted to their original active status.

The *Central Arizona Irrigation and Drainage District (CAIDD)* is the largest irrigation district in the PAMA in terms of the number of active IGFR irrigation acres in 2015 The district includes nearly 85,000 active irrigation acres associated with 356 IGFRs. Of these, about 30,300 acres constituting 113 enrollees, comprising one or more IGFRs, are in the Best Management Practices (BMP) Program; this constitutes 32 percent of the total number of active IGFR irrigation acres in the district. In 2015, CAIDD used 288,547 ac-ft of water, of which approximately 35 percent was CAP water; the balance was groundwater or in-lieu groundwater.

Maricopa-Stanfield Irrigation and Drainage District (*MSIDD)*, the second largest irrigation district in the Pinal AMA included approximately 76,400 irrigation acres in 2015 associated with 399 IGFRs. As of 2015, nearly 23,000 of these acres, or 30 percent, were regulated under the BMP Program. These acres were included in 74 enrollees in the program. MSIDD used 270,878 ac-ft in 2015, and about 41 percent of that volume was CAP water; the balance was groundwater or in-lieu groundwater.

Hohokam Irrigation and Drainage District (HIDD) comprised approximately 27,700 active irrigation acres in 2015. Of those acres, almost 73 percent, or about 20,200 acres, were enrolled in the BMP Program and included 73 enrollees with one or more IGFRs. HIDD used 90,885 ac-ft in 2015, of which 40 percent or 36,230 ac-ft was CAP water. The balance of HIDD's supply in 2015 was groundwater or in-lieu groundwater.

San Carlos Irrigation and Drainage District (SCIDD) included approximately 44,900 active irrigation acres in 2015. Of these acres, about 5,100 acres were enrolled in the BMP Program with 23 enrollees comprising one or more IGFRs. In 2015 SCIDD used about 146,000 ac-ft of water including loss and use by IGFRs within the district who used their own wells for groundwater. SCIDD provided 85,477 ac-ft of surface water in 2015. The remaining demand was met mostly with groundwater, although some CAP and reclaimed water was also used in the SCIDD in 2015.

As of 2015, there were 21,246 irrigation acres in the PAMA that were not served by an irrigation and drainage district. Just under 1,900 of these acres were enrolled in the BMP Program with 14 enrollees made up of one or more IGFRs. In 2015, non-district farms used 36,596 ac-ft of groundwater.

Although nearly 27,000 acres have been retired and converted to Type 1 Non-Irrigation GFRs or have been extinguished in the PAMA, the agricultural demand has not declined over time, but instead appears to be increasing. The remaining farms are using as much, or more, water than has historically been used in the PAMA, due to the possibility of double cropping, or growing different crops that use more water per acre than the crops historically grown. Agriculture is anticipated to remain the dominant water use sector in the PAMA into the future.

TABLE 3-6
PINAL AMA COMPARISON OF IRRIGATION ACRES AND DEMAND BY DISTRICT

District	1MP* Acres	1MP* Demand	2015 Acres	2015 Demand	Change in Acres	Percent Change in Acres	Change in Demand	Percent Change in Demand
MSIDD	88,068	194,721	76,448	270,878	-11,620	-13.2%	76,157	39.1%
CAIDD	87,087	169,833	84,745	288,547	-2,342	-2.7%	118,714	69.9%

District	1MP* Acres	1MP* Demand	2015 Acres	2015 Demand	Change in Acres	Percent Change in Acres	Change in Demand	Percent Change in Demand
HIDD	26,691	81,099	27,687	90,885	996	3.7%	9,786	12.1%
SCIDD	45,860	257,465	44,936	145,904	-924	-2.0%	-111,561	-43.3%
Non-district	34,256	88,974	21,246	37,262	-13,010	-38.0%	-51,712	-58.1%
TOTAL	**281,962**	**792,092**	**255,062**	**833,476**	**-26,900**	**-9.5%**	**41,384**	**5.2%**

*1MP is approximately the year 1987.
NOTE: Non-district 1MP figures have been adjusted based on updated querying techniques employed in the development of the Assessment and may not match figures shown in Table IV-1 of the PAMA 1MP.

Table 3-6 compares the total water use and irrigation acres by district as published in the First Management Plan (1MP) with the year 2015. While acres have gone out of production, water demand has increased. Although SCIDD and non-district demand has gone down, MSIDD, CAIDD and HIDD demand has increased. Most of the reduction in acres has occurred on non-district land and in MSIDD.

3.2.7 Tribal Sector

The Ak-Chin Indian Community and portions of both the GRIC and the Tohono O'odham Indian Nation (TON) are also located within the PAMA. Tribal water use is exempt from regulation by the state; however, the demand characteristics of these communities are included here because they have a hydrologic impact on the aquifer. In Table 3-1B tribal demand includes primarily agricultural demand with a small portion of municipal demand. Municipal demand is estimated to have been about 371 ac-ft in the year 2015.

The *Ak-Chin Indian Community* uses CAP water for agricultural irrigation. Since 1988, the Ak-Chin have used an average of 73,200 ac-ft per year of CAP water for irrigation of crops.

The *Tohono O'odham Indian Nation* includes the Chui Chu and Vaiva Vo areas, both within the Sif Oidak District. ADWR estimates that 13,000 ac-ft per year of groundwater is used to irrigate crops on TON land within the PAMA.

The *Gila River Indian Community* extends into both the PHXAMA and the PAMA along the Gila River, however, most of the GRIC farming operations are within the PHXAMA. In 2015, ADWR estimates that 66,163 ac-ft were used for agricultural irrigation in GRIC land within the PAMA.

Table 3-7 shows water use by water type for tribal uses.

TABLE 3-7
PINAL AMA HISTORICAL TRIBAL DEMAND BY WATER TYPE, 1985 – 2015 (ac-ft)

Year	Groundwater	Surface Water	CAP Water	Reclaimed
1985	24,525	29,120	0	0
1986	60,962	26,560	0	0
1987	46,580	28,480	19,000	0
1988	59,237	28,800	64,000	0
1989	52,374	29,280	63,000	0
1990	52,692	5,600	67,000	0
1991	50,049	21,920	72,000	0
1992	47,007	26,720	71,000	0
1993	48,124	23,520	77,000	0

Year	Groundwater	Surface Water	CAP Water	Reclaimed
1994	49,242	28,000	80,000	0
1995	58,199	27,200	76,000	0
1996	59,477	28,000	82,000	0
1997	63,154	17,280	72,000	0
1998	59,792	18,560	65,000	0
1999	62,349	9,760	69,000	0
2000	61,547	12,960	69,000	0
2001	61,544	14,400	64,000	0
2002	62,342	2,880	81,920	0
2003	62,819	4,640	77,800	0
2004	62,537	6,400	76,840	0
2005	60,774	16,960	72,000	0
2006	61,412	13,600	80,720	0
2007	61,919	13,982	86,580	0
2008	62,946	9,484	84,895	0
2009	63,307	11,984	89,122	0
2010	61,921	18,207	77,622	0
2011	64,507	8,137	82,676	0
2012	64,270	3,459	87,925	0
2013	63,955	4,068	86,413	0
2014	63,272	6,440	82,270	0
2015	63,248	11,606	82,699	0

NOTE: Tribal groundwater is for municipal/domestic purposes and is estimated assuming 57 GPCD and the growth rate between the 2000 and 2010 Census population. Tribal agricultural demand equals the reported delivery of CAP water to tribal land as reported by CAWCD and CAP, surface water and groundwater reported as being delivered to tribal land by the San Carlos Irrigation District, along with ADWR estimates of groundwater use within TON lands in the PAMA.

3.3 CURRENT WATER BUDGET

The management goal of the PAMA is to allow the development of non-irrigation water uses, extend the life of the agricultural economy as long as feasible, and preserve water supplies for future non-irrigation uses. Net natural recharge and the other components in the calculation of overdraft are described in the Assessment (ADWR, 2011) in Part 3, "The Basic Budget Components." Overdraft is equal to the sum of the groundwater use for all the sectors (estimated for exempt well demand), minus the sum of the incidental recharge, plus the additional offsets to overdraft (including net natural recharge and canal seepage). Despite increased use of renewable supplies, predominantly CAP water, overdraft continues in the PAMA.

For purposes of the 4MP, overdraft includes use of the AWS groundwater allowance. Despite these volumes of groundwater use being considered consistent with the management goal under the AWS Rules, they are included in the overdraft calculation to allow analysis of the groundwater allowance withdrawal's physical impact on the aquifer.

Rather than using a long-term average for stream channel recharge as was done in the Assessment, the actual estimated stream channel recharge from the hydrologic model has been incorporated into the budget template in order to show the impact of flood flow on the aquifer, as in the year 1993. ADWR now has a greater understanding of the susceptibility of the PAMA aquifers to drought and natural recharge during

wetter periods. This period of record indicates that the PAMA experienced years of surplus related to flood events and high volumes of agricultural incidental recharge prior to 1996, however, since 1996 overdraft has averaged 120,000 ac-ft per year. Cumulative overdraft for the historical period was approximately 1.9 million ac-ft. Values are shown in Table 3-8. The net natural recharge in Chapter 2, Table 2-2 and offsets to groundwater pumping in Table 3-8 do not match; this is because Table 3-8 includes incidental recharge from human activities, cuts to the aquifer, CAGRD replenishment, effluent discharge, riparian use and canal seepage, while Table 2-2 in Chapter 2 does not.

3.4 CONCLUSION

Water users in the PAMA have increased their use of CAP and reclaimed water over the historical period of 1985 through 2015. Historically the PAMA's largest water sector was the agricultural sector. Although the municipal sector has grown along with the other sectors, agriculture is still dominant in PAMA. The response of this sector to future planned reductions in the CAP agricultural pool and in the availability of excess water used for in-lieu recharge could affect the availability of groundwater not only to agricultural users but also for future non-irrigation users in the PAMA in the future.

The 4MP programs that follow were developed within current statutory guidelines. Based on the assumptions described in Chapter 11, implementation and compliance with the conservation requirements outlined in Chapters 4, 5 and 6 may still result in an estimated 105,000 ac-ft of overdraft in the PAMA in 2025. Developing and putting into place a water management strategy that achieves the goal of the PAMA will help ensure that sufficient water supplies are available for all water using sectors in the PAMA, which will contribute to the continued economic viability of the AMA into the future. This situation is further discussed in Chapter 12.

TABLE 3-8
PINAL AMA WATER DEMAND BY SECTOR, 1985 – 2015 (ac-ft)

Year	Municipal Provider Demand	Exempt Well Demand	Industrial Demand	Agricultural Demand	Tribal Demand	TOTAL AMA DEMAND	Renewable Supplies to Meet Demand[1]	GW to Meet Demand	Offsets to GW Pumping[2]	Overdraft
1985	12,984	175	4,955	792,092	53,645	**863,851**	226,377	637,475	636,416	**-1,058**
1986	14,317	188	4,692	681,160	87,522	**787,879**	191,962	595,917	466,875	**-129,042**
1987	15,278	202	4,120	760,311	94,060	**873,971**	278,946	595,025	468,905	**-126,120**
1988	15,103	217	4,312	813,672	152,037	**985,341**	418,022	567,319	531,328	**-35,991**
1989	15,637	233	4,321	945,290	144,654	**1,110,136**	565,436	544,700	566,907	**22,207**
1990	14,965	251	4,875	732,494	125,292	**877,877**	406,559	471,318	407,992	**-63,326**
1991	15,040	270	5,574	742,286	143,969	**907,139**	420,464	486,675	431,654	**-55,021**
1992	15,520	290	6,023	637,503	144,727	**804,063**	345,147	458,915	531,313	**72,397**
1993	15,731	312	5,192	620,147	148,644	**790,026**	300,581	489,445	1,016,340	**526,895**
1994	16,510	335	5,216	784,621	157,242	**963,924**	587,303	376,621	496,901	**120,280**
1995	17,840	360	5,647	885,900	161,399	**1,071,146**	587,874	483,273	619,654	**136,382**
1996	18,793	387	6,434	1,022,389	169,477	**1,217,480**	610,074	607,406	613,402	**5,996**
1997	19,424	416	6,648	930,111	152,434	**1,109,033**	470,384	638,649	537,046	**-101,603**
1998	19,293	448	8,098	841,487	143,352	**1,012,677**	492,018	520,660	518,281	**-2,378**
1999	20,917	481	9,590	764,710	141,109	**936,807**	396,243	540,564	457,337	**-83,227**
2000	20,953	517	9,653	810,109	143,507	**984,738**	393,055	591,683	507,076	**-84,608**

Year	Municipal Provider Demand	Exempt Well Demand	Industrial Demand	Agricultural Demand	Tribal Demand	TOTAL AMA DEMAND	Renewable Supplies to Meet Demand[1]	GW to Meet Demand	Offsets to GW Pumping[2]	Overdraft
2001	22,207	731	11,883	830,720	139,944	**1,005,485**	467,284	538,201	479,175	**-59,027**
2002	24,531	945	13,465	870,179	147,142	**1,056,261**	426,379	629,883	496,877	**-133,006**
2003	24,540	1,159	14,191	845,454	145,259	**1,030,603**	438,393	592,210	489,837	**-102,373**
2004	25,520	1,373	15,046	809,510	145,777	**997,225**	408,378	588,848	482,270	**-106,578**
2005	27,395	1,586	18,696	809,891	149,734	**1,007,303**	487,081	520,222	528,804	**8,582**
2006	30,448	1,800	20,243	819,894	155,732	**1,028,117**	454,170	573,947	605,837	**31,890**
2007	34,765	2,014	25,905	978,778	162,481	**1,203,944**	498,069	705,875	570,206	**-135,669**
2008	34,746	2,228	28,423	1,037,653	157,325	**1,260,374**	566,311	694,063	590,586	**-103,477**
2009	34,306	2,442	25,014	896,932	164,413	**1,123,107**	530,857	592,251	494,063	**-98,187**
2010	32,965	2,656	21,565	868,995	157,750	**1,083,931**	513,461	570,471	478,338	**-92,132**
2011	33,316	2,841	20,199	1,001,126	155,320	**1,212,802**	440,962	771,840	441,949	**-329,892**
2012	33,019	3,039	17,434	928,761	155,653	**1,137,906**	391,469	746,437	409,587	**-336,851**
2013	32,441	3,251	15,714	883,043	154,436	**1,088,885**	418,096	670,789	398,695	**-272,094**
2014	32,976	3,478	19,831	894,630	151,982	**1,102,898**	462,028	640,869	428,694	**-212,176**
2015	33,463	3,720	20,986	834,976	157,553	**1,050,698**	698,572	601,525	415,802	**-185,723**

[1] Includes CAP Water, Surface Water, and Reclaimed Water

[2] Includes Incidental Recharge, Net Natural Recharge, Cuts to the Aquifer, CAGRD Replenishment, Riparian Use, and Canal Seepage

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